What Is Claimed:

1. Method of controlling an accelerator coupled nuclear system (ACS) comprising a nuclear reactor operating in subcritical mode and a neutron generator device using a beam of accelerated charged particles, the neutron generator supplying the quantity of neutrons necessary to maintain the nuclear chain reaction in the core, and the operating point of the system being selected more or less around the optimal point at which the relationship between the number of external neutrons produced and the energy of the proton beam having been used to produce them is maximum, this method being characterized in that the number of external neutrons is adjusted depending on the power fluctuations of the nuclear reactor by acting on the energy of the charged particles (E_p) generated and accelerated by the accelerator.

2. Method of controlling an accelerator coupled nuclear system (ACS) in accordance with claim 1, characterized in that it comprises the following steps:

1. determining the operating conditions under which it is desired to operate the nuclear reactor: level of subcriticality (r_0), consumable power to be produced, thermal power P_{th} or electric power $P_{el} = \eta_{el}P_{th}$ where η_{el} is the electric yield of the plant, quantity and kind of fuel,

2. from these conditions, determining the operating parameters of the accelerator as follows:

a - determining the optimal energy E_p^{Max} of the charged particles, which verifies the expression:

$$d/dE_p\ [\varphi^*(E_p)\eta_a(E_p)Y_n(E_p)/E_p] = 0 \qquad (1)$$

in which E_p is the energy of the incident particles, Y_n is the neutron yield, φ^* is the neutron importance, and η_a is the yield of the accelerator,

b - selecting the operating energy (nominal energy) E_p^{nom} equal to or greater than the optimal energy E_p^{Max}:

$$E_p^{nom} = E_p^{Max} + \Delta E_p,\ \Delta E_p \geq 0. \qquad (2)$$

c - determine the nominal intensity I_p^{nom} of the beam of charged particles necessary to obtain the nominal power of the reactor P_{th}^{nom} depending on the nominal

energy E_p^{nom}, on the neutron yield $Y_n(E_p^{nom})$, on the yield of the accelerator $\eta_a(E_p^{nom})$, on the average number v of fission neutrons, on the energy E_{fis} supplied in a fission reaction, and on the neutron importance $\varphi^*(E_p^{nom})$ for the nominal energy E_p^{nom}:

$$I_p^{nom} = r_0 \nu P_{th}^{nom}/[E_{fis}\varphi^*(E_p^{nom})Y_n(E_p^{nom})], \quad (3)$$

as well as the fraction of the power produced by the reactor that is consumed by the accelerator:

$$f^{nom} = E_p^{nom} r_0 \nu/[E_{fis}\varphi^*(E_p^{nom})Y_n(E_p^{nom})\eta_a(E_p^{nom})\eta_{el}], \quad (4)$$

3. set the fraction f of the power produced by the reactor that can be consumed by the accelerator, as well as the intensity of the incident particle beam at nominal values according to the following formulas:

$$I_p^{nom} = r_0 \nu P_{th}^{nom}/[E_{fis}\varphi^*(E_p^{nom})Y_n(E_p^{nom})], \quad (3)$$
$$f^{nom} = E_p^{nom} r_0 \nu/[E_{fis}\varphi^*(E_p^{nom})Y_n(E_p^{nom})\eta_a(E_p^{nom})\eta_{el}], \quad (4)$$

4. adjust the number of external neutrons acting on the particle energy E_p with constant beam intensity, depending on the operating power fluctuations of the nuclear reactor, according to the expression determining the variation of the energy:

$$E_p = f^{nom} P_{el} \eta_a(E_p)/I_p^{nom} \quad (5)$$

3. Method of controlling an accelerator coupled nuclear system in accordance with claim 1 or 2, in which the operating point has a particle energy E_p equal to the optimal value E_p^{Max} of this particle energy.

4. Method of controlling an accelerator coupled nuclear system in accordance with claim 1 or 2, in which the operating point has a particle energy E_p greater than the optimal value E_p^{Max} of this particle energy.

5. Method of controlling an accelerator coupled nuclear system in accordance with claim 4, in which the operating point has a particle energy E_p equal to $E_p^{Max} + \Delta E_p$ where E_p^{Max} is the optimal value of this particle energy or where the value ΔEp is selected so as to be much greater than possible negative power fluctuations of the reactor in the normal operating mode of the reactor.

6. Method of controlling an accelerator coupled nuclear system in accordance with any of the above claims, in which the particles are protons, and the neutron-generating nuclear reaction is a spallation reaction.

7. Method of controlling an accelerator coupled nuclear system in accordance with claim 6, in which the spallation target is made of lead-bismuth, and the optimal proton energy E_p^{Max} ranges from 0.5 GeV to 2.5 GeV.

8. Method of controlling an accelerator coupled nuclear system in accordance with any of the claims 1 through 4, in which the particles are electrons, and the neutron-generating nuclear reaction is a photonuclear reaction.

9. Accelerator coupled nuclear system comprising a nuclear reactor operating in subcritical mode and a neutron generator device using a beam of accelerated charged particles, the neutron generator supplying the quantity of neutrons necessary in order to maintain the nuclear reaction, characterized in that the number of neutrons induced by the accelerator is controlled by acting on the particle energy E_p, with constant beam intensity of the particles.

10. Accelerator coupled nuclear system in accordance with claim 9, for which the charged particles are protons directed in a beam at the center of the core, and the core comprises a spallation target.

11. Accelerator coupled nuclear system in accordance with claim 9 or 10, for which the nominal particle energy E_p is greater than the value E_p^{Max}, optimizing the yield of the nuclear reaction producing the neutrons.

12. Accelerator coupled nuclear system in accordance with any of the claims 9 through 11, in which the actual target is surrounded by a buffer, whose conversion yield is less than half of the conversion yield of the actual target.